UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/770,804	01/26/2001	Paul W. Dent	000875	8250

7590 10/19/2004

David E. Bennett
Coats & Bennett, P.L.L. C.
1400 Crescent Green, Suite 300
Cary, NC 27511

EXAMINER	
BOCURE, TESFALDET	

ART UNIT	PAPER NUMBER
2631	

DATE MAILED: 10/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

μ

Office Action Summary	Application No.	Applicant(s)	
	09/770,804	DENT ET AL.	
	Examiner	Art Unit	
	Tesfaldet Bocure	2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37 and 39-63* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-33* is/are allowed.

6)☐ Claim(s) *34-37 and 39-63* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The Examiner has not considered the information disclosure received on October 9, 2003 because the reference cited, US patent number 4,422,047, and by the Applicant is the same as the once cited by the Examiner in the office action mailed on April 14, 2003. Therefore, considering the above-cited reference will show in the front of the patent twice.

Drawings

2. The formal drawings received on January 28, 2002 have been approved by the Draftsperson.

Claim Objections

3. Claims 39 and 40 are depending on a canceled claim, claim 38. Examiner suggests Applicant to amend the dependency of claim 39 from claim 38 to claim 34.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 34,35,41-47,50-55,58,62 and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sroka et al. (US patent number 5,778,308, of a record).
In view of Seward (US patent number 4,485,360, newly cited).

Sroka et al. (Sroka hereinafter) teaches a wireless communication device (fig.2) for transmitting and receiving signals in multiple transmit and receive frequency bands (see col. 2, lines 53-60 for the mobile unit moving from one base station to another having inherent respective frequencies) using Time Division Multiple Access (TDMA) signal formats (see col. 2, line 53 through col. 3, line 8), the wireless communications device comprising: an antenna (17) for transmitting signals to and receiving signals from a wireless communications network; a transmit/receive switch (duplexer 18 having inherent switch) selectively coupling the antenna to a transmit signal path during a transmit time slot of a frame period of the TDMA signal format, and selectively coupling the antenna to a receive signal path during a receive time slot of the TDMA frame period; a variable matching network (25)

connected in the transmit signal path between the antenna and a selected transmit power amplifier (24) corresponding to a selected transmit frequency band (see col. 3, lines 1-7); an impedance mismatch measuring and quantizing unit (32-40 in figures 3A-3c) connected in the transmit signal path between the power amplifier and the variable matching network (31), the impedance mismatch measuring and quantizing unit measuring forward and reflected power of a signal transmitted (return path and forward path in figures (return path and forward path in figure 3A, see also col. 4, lines 6-33 and col. 6, lines 5-23) on the selected transmit frequency band, and generating mismatch indication signals providing a quantized indication of antenna impedance mismatch, the impedance mismatch measuring and quantizing unit generating the mismatch indication signals during the transmit time slot of the TDMA frame period (see col. 6, lines 1-7); and a control processing unit (32,) receiving and processing the mismatch indication signals and providing adjustment control signals to the variable matching network during idle time of the TDMA frame period i.e., during time not utilized by the wireless communications device for transmission (see abstract where the controlling step is performed during an ideal period).

Further to claims 35,41-47,50-55,58,62 and 63 Sroka teaches that:

the control-processing unit to the variable matching network provides the adjustment control signals during a portion of the TDMA frame period not used by the wireless communications device for reception (see abstract) as in claim 35;

the method of optimizing impedance between a transceiver (fig.2) and an antenna (17) in a wireless communications device comprising: measuring a signal to determine a complex reflection coefficient (see figs 3A-4) indicative of a quality of an impedance mismatch between a transceiver and an antenna at a selected frequency band; detecting an impedance mismatch between the transceiver and the antenna at the selected frequency band; and automatically adjusting a variable impedance matching network (31) in the wireless communications device, during an idle period of communications, to minimize the impedance mismatch at the selected frequency band as in claim 41;

wherein measuring a signal to determine a complex reflection coefficient comprises measuring amplitude and phase of a reflected power of a transmitted signal (see the col. 5, lines 20-24 for the application of Smith chart and the attached smith chart) during a TDMA transmit slot (see col. 6, lines 1-7) as in claim 42;

wherein measuring a signal to determine a complex reflection coefficient further comprises measuring a forward power of the transmitted signal during the TDMA transmit slot (see col. 6, lines 1-7) as in claim 43;

wherein detecting an impedance mismatch between the transceiver and the antenna at the selected frequency band comprises determining the magnitude of the forward power relative to the magnitude of the reflected power of the transmitted signal (se for return and forward path in figure 3A) as in claim 44;

wherein detecting an impedance mismatch between the transceiver and the antenna at the selected frequency band comprises quantizing the complex

reflection coefficient into one of a predetermined number of quality levels (see for the quality levels in the Smith chart and the incorporation by reference to Smith chart disclosed in col. 5, lines 20-25) as in claim 45;

wherein detecting an impedance mismatch between the transceiver and the antenna at the selected frequency band is based on the quality levels as in claim 46 (see Smith chart for quality level in which the processor generates a control signal) as in claim 46;

wherein quantizing the complex reflection coefficient into one of a predetermined number of quality levels comprises quantizing the complex reflection coefficient into one of a plurality of amplitudes and one of a plurality of phases (see the X and y planes in the Smith chart) as in claim 47;

wherein automatically adjusting a variable impedance matching network during an idle period of communications comprises increasing or decreasing capacitance in the variable impedance matching network (see abstract) as in claim 50;

wherein automatically adjusting a variable impedance matching network during an idle period of communications to minimize the impedance mismatch occurs during an idle slot of a TDMA frame (see abstract) as in claim 51;

a method of optimizing impedance between a transceiver and an antenna in a wireless communications device comprising: measuring a forward power and a reflected power (see return and forward paths) of a transmitted signal transmitted on a selected transmit frequency band; generating an impedance mismatch signal to a controller (32) during the transmit time slot of the TDMA frame based on the

quantized forward power and reflected power; adjusting a variable impedance matching network (31) responsive to the impedance mismatch signal, during an idle period of communications in the TDMA frame (see abstract), to minimize an impedance mismatch between the antenna and a transceiver at the selected frequency as in claim 52;

wherein adjusting a variable impedance matching network responsive to the impedance mismatch signal comprises generating an adjustment control (see output from processor 32) signal to the variable matching network (31) as in claim 53;

quantizing the forward power and the reflected power of the transmitted signal transmitted on the selected transmit frequency band (see for the transmit frequency in col. 3, lines 1-7) as in claim 54;

determining a complex reflection coefficient from the quantized forward power and reflected power of the transmitted signal (see col. 4, lines 1-33) as in claim 55;

the method of claim 55 wherein generating an impedance mismatch signal to a controller comprises generating a coarse indication of the phase of the complex reflection coefficient (see col. 4, lines 1-33) as in claim 58;

selectively coupling an antenna to a receive signal path during a receive time slot of a TDMA frame, and a transmit signal path during a transmit time slot of a TDMA frame (duplexer 18) as in claim as in claim 62; and

an impedance optimization circuit for a wireless communications device comprising: a controller programmed to (figure 3A-4) measure a forward power and

a reverse power of a transmitted signal (see return and forward path in figure 3A) on a selected frequency band to determine the quality of an impedance match between a transceiver (fig.2) and an antenna (17) at the selected frequency band; detect an impedance mismatch (32-40) between the transceiver and the antenna at the selected frequency band; and adjust an variable impedance matching network (31), during an idle period of communications, to minimize the impedance mismatch between the transceiver and the antenna at the selected frequency band (see abstract) as in claim 63.

Sroka teaches the reflection coefficients are calculated in response to the amplitude and phase of the reflected signal as indicated above with respect to the rejection of claim 42. However he does not show clearly as the load impedance is corrected in response to the measured phase as in claims 34,41,52 and 63.

Seward for the same endeavor as the instant application and that of Sroka teaches an adaptive impudence matching between the antenna and that of the transmitter components having means for measuring the amplitude and phase of the refection coefficients and adjusting the load impudence according the measured phase. See claim 23 of Seward. Therefore, it would have been obvious to one of an ordinary skill in the art to use the measured phase as in the case of Sroka and as thought by Seward to correct the impedance mismatch at the time the invention was made.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 36,37,39,40,48,49,56,57 and 59-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sroka et al. (US patent number 5,778,308, newly cited). Sroka teaches the claimed subject matter in claims 34,38,41,45,52,54,55 and 58 as indicated above.

Sroka teaches that if the reflection coefficient is suitably small, it is assumed that the antenna matching is good enough and further adaptation of network is effective (see col. 6). In the other hand, if the coefficient is greater than the first predetermined values and less than the second predetermined value the adaptation algorithm is effected in attempt to improve matching between the and antenna and associated circuit

What Sroka fails to teach is that:

a first bit indicative of whether a reflection coefficient magnitude developed from the measured forward and reflected power it is less than or greater than a predetermined value as in claims 36 and 37;

wherein the mismatch indication signals include a 2-bit quadrant indication portion indicating in which quadrant of a complex plane the reflection coefficient lies as in claim 39;

wherein the control-processing unit to output the adjustment control signals from a precomputed look-up table as in claim 40 processes the 2-bit quadrant indication portion;

averaging a plurality of quantized complex reflection coefficients to determine an average complex reflection coefficient value as in claim 48;

inputting the averaged and complex reflection coefficient values into a controller as in claim 49.

generating an impedance mismatch signal to a controller comprises generating a two-bit quadrant indication representative of a quadrant in a complex plane in which the complex reflection coefficient lies as in claim 59;

comparing the two-bit quadrant indication with predetermined values in a lookup table as in claim 60; and

generating the adjustment control signal based on the predetermined values in the lookup table as in claim 61.

However such of use of two bits and lookup table and averaging of signal to control anything including the impedance of the antenna is widely used and Examiner taking an official notice.

Therefore it would have been obvious to one of an ordinary skill in the art to use the a digital control signal of Sroka to have the claimed bits for controlling the impedance mismatch between the antenna and circuitry at the time the invention was made.

Response to Amendment

9. Applicant's arguments with respect to claims 1-37 and 39-63 have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

10. Claims 1-33 are allowed.

11. The following is a statement of reasons for the indication of allowable subject matter: The claimed subject matter in claims 1-33 is allowable because the arts of record fail to teach or fairly suggest the claimed "a wireless communications device for transmitting signals in a first plurality of transmit frequency bands and for receiving signals in a second plurality of receive frequency bands, the wireless communications device comprising:

an antenna for transmitting signals to and receiving signals from a wireless communications network; and

an adjustable matching network (52) selectively connecting the antenna to a select one of <u>a third plurality of transmit power amplifiers</u> (601-60n) corresponding to <u>the first plurality of transmit frequency bands</u> for signal

transmission, the adjustable matching network matching an impedance of the antenna to the select one transmit power amplifier as in claim 1."

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tesfaldet Bocure whose telephone number is (703) 305-4735. The examiner can normally be reached on Mon-Thur (7:30a-5:00p) & Mon.-Fri (7:30a-5:00p).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad H Ghayour can be reached on (703) 306-3034. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4700.

Tesfaldet Bocure
Primary Examiner
Art Unit 2631

T.Bocure